ADDITIONAL NOTES ON ARGULUS TRILINEATUS (WILSON)

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The female of this species was described by Wilson (1904) from specimens collected on goldfish in Georgia and Kentucky. Cockerell later identified them in Colorado and suggested that they might be closely related to *Argulus coregoni*. Guberlet described the males for the first time in 1928 from specimens taken on goldfish in Washington and California. Since that time they have been recognized in a great many places over the country, so that the distribution is quite extensive.

The present specimens were taken from goldfish, *Carassius auratus*, at Natchitoches, Louisiana. These have been compared with types 56568 loaned by the U. S. National Museum, and with *A. coregoni* sent by the British National Museum. Dr. Zacwilichowski of Jagelon University, Krakow, Poland, was kind enough to send female specimens of *Argulus foliaceous*, while Dr. Schellenberg of "Der Zoologisches Museum der Universität, Berlin, Germany, sent both males and females for comparative purposes. There has been no opportunity to examine the type for *A. trilineatus* (Wilson).

The one significant feature overlooked in the original description that sets the species apart from all others in America is that the ribs on the dorsal side of the carapace are forked as in the European species. Guberlet showed this in figure 1 of his monograph, but failed to mention it. Wilson (1903) stated that it is one of the characteristics distinguishing the European species since none of the American species which he had observed had such a modification.

To be sure the branches are not readily apparent on some specimens, but are very obvious on others. They are found on the specimens from the National Museum, as well as those from Louisiana. One can make them distinguishable by staining lightly with methylene blue. After it has once been called to attention, one can readily see, from the offset of the rib in the region of the base of the antennae, that the shape is such as to suggest the presence of a branch. This feature is

no more apparent on some specimens of *A. foliaceous* than on the American species. At the same time these ribs are definitely bowed inward between the eye and sucker regions and outward around the brain rather than nearly parallel as previously described. Figure 1 shows all of these characteristics.

A perusal of the European literature from 1800 on would lead one to suspect that *A. trilineatus* might be exactly like *A. foliaceous* except for size. An examination of the description and figures by Claus (1875), which seem to be the most complete, reveals that his description follows the American species almost identically. In his paper, figure 22 of the respiratory areas is identical with our species, figure 25 of the dorsal ribs is the same, figure 20 shows the antennae exactly alike, while figure 26 has four leaves between the ribs of the sucker and five to six plates in each of these ribs with the same shape as the local species. His figure 44 is a drawing of the accessory sex organs of the last two pairs of legs which might have been taken from American specimens. Even the spines on the comb and second and third segments of the second maxillipeds, which are different on each of the European species, are similar, so that all details described and figured are alike for *A. foliaceous* and *A. trilineatus*.

Although Claus has drawn a "peg" identical to that of the American species, the European specimens at hand are somewhat different. Figures 2 and 3 are drawings of the organs from the two; figure 2 is that of the American form. They do show a similarity, but are not as much alike as shown by him. On the German specimens at hand this structure is much less chitinous and does not become as spatulate. This would seem to indicate that both species have changed somewhat.

No mention was made in any of the European literature of the accessory organs on the second pair of legs of the male. Wilson (1904), in his description of *A. foliaceous*, states, ". . . Abdomen in the male considerably elongated, but no copulatory organs except the regular peg and semen vesicle. . . ." An examination of specimens shows that there is an accessory organ on these legs such as that shown in figure 4.[1] There is considerable difference between this and figure 5, which is the same organ on *A. trilineatus*. This structure is almost identical with that of *A. coregoni*.

[1]A paper by Wagler (1935) was called to my attention since gathering this data. It has a good figure of the organ (Fig. E, p. 8).

Communications with two European authorities state that there is confusion in the identification of the two native species. If they do actually intergrade, as one would be led to believe, it is very possible that the American form is derived from European stock not so far back. Such is indicated by the fact that they are found only on goldfish in this country, most of which are of European origin, and because it has some of the distinguishing marks of both of the species found there.

There are certain other features of *A. trilineatus* which have either been missed or not adequately described. Chief among these is the structure of the second antennae. Wilson definitely states that there are two distal segments (1904, p. 652 and fig. 26) and Guberlet says, "The basal joint of the second antennae is longer and thicker than the two distal joints." On all of the specimens examined, including those from the Museum, there are three distal segments as shown in figure 6. The apparent oblique direction of these segments that has been noted for some specimens, is wholly due to the fact that they are attached on the posterior edge of the basal segments and the direction is dependent upon the way they are flexed when the animal is killed. It is variable from specimen to specimen and probably is of no specific value.

On the first maxillipeds the ribs are composed of a series of plates similar to figure 7. These increase in size from the outer to the inner edge and number five or six with an additional basal plate supporting them on the inner rim. The number is variable even in the same appendage on some animals. The number of leaves along the outer edge of the disc, counting between the ribs, varies from five to eight, but five or six is the common number.

The respiratory areas are not exactly as figured by Wilson. They are somewhat narrower at the top than at the bottom with a depression on the side toward the body, so that the appearance is almost reniform. The anterior respiratory area is egg-shaped with the point toward the body and between the sucker and posterior respiratory area. These are shown in figure 8.

The accessory organs of the male have already been described. Martin (1932) made observations on the copulating animals and found that they are used for clasping rather than for the actual transfer of the sperms as some of the earlier authors have intimated. From the shape of the armature of

the organs figured in the literature, and from the fact that the genital openings are nowhere near them, it is easy to visualize the possibility that such is the case.

There seems to be no structure such as the "flattened bladelike" projection on the anterior border of the second pair of legs as described by Guberlet. The nearest approach to such a formation occurs in many instances where the musculature has pulled away from the exoskeleton on mounted specimens, but this is not confined to the second legs alone. There is a flat plate-like area between the second and third legs.

The pigment spots, from which the American species gets its name, are also found on *A. foliaceous* and are arranged in two double rows, one on either side of the abdomen. These are decidedly a more distinct characteristic of the female than of the male. The male is characterized by the large amount of pigment in the lateral canals extending out into the wings of the carapace on either side and dividing into two branches, one running forward and the other backward and dividing into numerous smaller lateral branches extending toward the outer edges. There are other species which have pigment along these canals. It is also found on the female but is not nearly so prominent.

Certain characters seem to be variable from one individual to the next. The carapace may reach the abdomen on some specimens and extend only to the third legs on others. There is some variation in the proportions according to the individual. There is variation in the size and length of the antennae. The number of plates in the ribs of the suckers may be different as well as the number of leaves between the ribs. On some specimens there is a definite cross rib between the joints of the dorsal ribs behind the brain, while on others it is not noticeable, but may be represented by a fold or be entirely lacking.

The striking similarity between *A. trilineatus* and *A. foliaceous*, including the branching of the dorsal ribs, definitely marks the American species as being of European origin. The shape of the peg, which is one of the specific characters, is similar. Such small details as the setae on the second maxillipeds, the number of plates in the ribs of the sucker, and the number of leaves between them are almost identical. The European species has a slightly different type of armature on the second legs in the male and lacks the flat protuberance between the second and third legs which is so characteristic of

the American form. The females of the two species are alike. If there is as much variation within the European species as is shown by Claus' figures and as compared with the specimens examined, then there is less difference between the species of the two continents than there is between the two from Europe.

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EXPLANATION OF PLATE

Fig. 1. Dorsal ribs of *A. trilineatus*.
Fig. 2. Accessory appendage of fourth legs on male.
Fig. 3. Similar appendage from *A.* foliaceous.
Fig. 4. Accessory appendage of second legs of male.
Fig. 5. Similar appendage on *A. trilineatus*.
Fig. 6. Antennae of *A. trilineatus*.
Fig. 7. Ribs of the sucking disc.
Fig. 8. Respiratory areas.

Argulus trilineatus
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PLATE I